

THE UNIVERSITY OF
SYDNEY

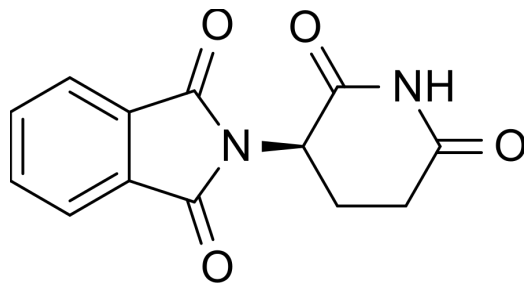
iGEM 2015

MycoMimic

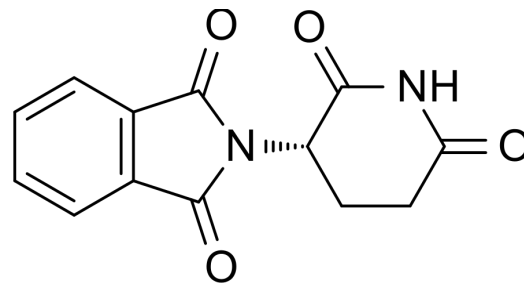


Thalidomide

- 1957
- 10000 children born with complications
- 50% survived



(R)-thalidomide



(S)-thalidomide

Overview

- Genetic engineering
- Develop organisms with useful applications
- Humanitarian – Golden Rice
- Environmental – Bt cotton



Benefits

- Express genes of interest
e.g. biocatalysis
- Develop organisms with desired applications
e.g. draught-resistant crops
- Replace defective genes
e.g. gene therapy, Cystic Fibrosis

iGEM – what is it?



MIT, Cambridge, Massachusetts
Research & modelling

TRANSPARENT AND OPEN SCIENCE

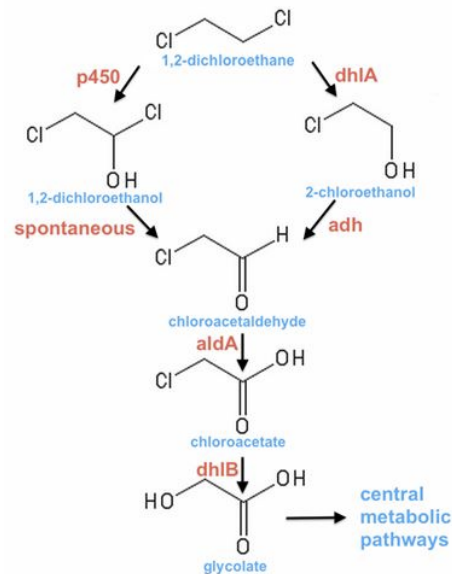
Dr Nicholas Coleman



- Senior Lecturer
- School of Molecular Biosciences
- 17 publications 2010-14
- Role of microorganisms in health and environment

iGEM Sydney - 2013

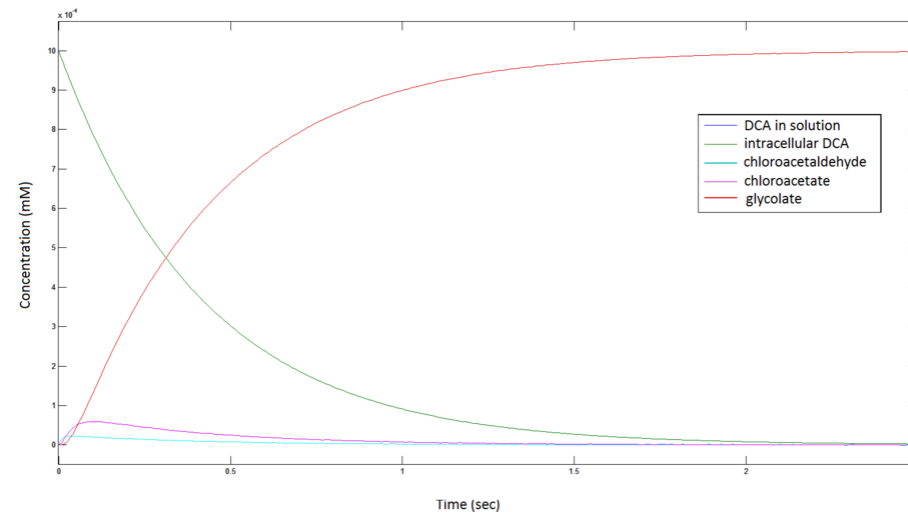
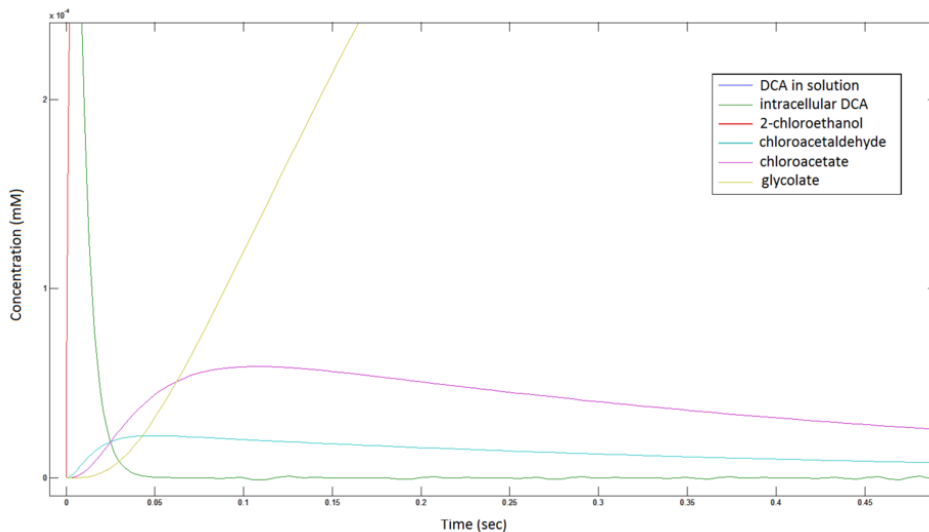
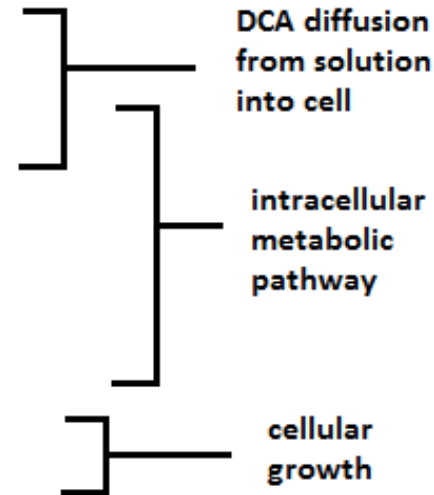
- Biodegradation of chloroethane
- Botany Bay pollution
- Degradation observed
- Problems with gene design
- Low activity



Modelling - 2013

$$\begin{aligned}\frac{d\alpha_{out}}{dt} &= -\Psi S J(\alpha_{out}, \alpha_{in}) \\ \frac{d\alpha_{in}}{dt} &= S J(\alpha_{out}, \alpha_{in}) - k_{cat} c C \frac{\alpha_{in}}{K_{MC} + \alpha_{in}} \\ \frac{d\gamma}{dt} &= k_{cat} c C \frac{\alpha_{in}}{K_{MC} + \alpha_{in}} - k_{cat} D D \frac{\gamma}{K_{MD} + \gamma} \\ \frac{d\delta}{dt} &= k_{cat} D D \frac{\gamma}{K_{MD} + \gamma} - k_{cat} E E \frac{\delta}{K_{ME} + \delta} \\ \frac{d\varepsilon}{dt} &= k_{cat} E E \frac{\delta}{K_{ME} + \delta} - 1.5789 * 10^{-10} ; \varepsilon > 0\end{aligned}$$

$$\frac{d\Psi}{dt} = 5 * 10^6 \text{ cells/mL given that glycolate is present}$$



MORE THAN SCIENCE – wiki

Easy cloni
USyd Australia

Home TEAM PROJECT PARTS OUTREACH SAFETY ATTRIBUTIONS

The Team

Integrans: Nature's cloning tool

1. 2. 3.

Strange Nature

Want to win up to \$500?
THE SYNTHETIC BIOLOGY
WRITING COMPETITION
Which advancement in
synthetic biology do you
think is the most "game-changing"
and why?

NEW in 2014
Undergraduate Division

USyd 2014
1 SEPTEMBER 19
2014
1 SEPTEMBER 23

With 1000 words required
by the above question - the
best entries are awarded
up to \$500

Home Project Parts Modelling Human Practices Safety Attributions Team

Sydney Australia
2015

MORE THAN SCIENCE- Outreach



The Science Show

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Syd Uni designer genomes in world competition

[Download audio](#) [show transcript](#)

Saturday 6 June 2015 12:41PM

It began in 2003 at MIT in Boston. Undergraduate teams of science students compete using the latest technology to design genomes or other complex molecules to solve real world problems or make current processes more efficient. Gaia Herrmann and Harrison Steel are part of the 2015 team from The University of Sydney. They describe their project and the possibilities using synthetic biology and



IMAGE: GAIA HERRMANN PREPARES A CENTRIFUGE (SYD UNI)



Saturday 12 noon
Repeated: Thursday 9pm

Presented by Robyn Williams

IN THIS PROGRAM

Charming spiders - Saturday 6 June 2015

[Download](#)

Spiders: they're bigger in cities
12:05 PM

Sydney snake once common, now endangered
12:12 PM

MORE THAN SCIENCE- Outreach



Outreach - Competition

**strange
NATURE 2015**

THE SYNTHETIC BIOLOGY
WRITING COMPETITION

**Want to win
up to \$500?**

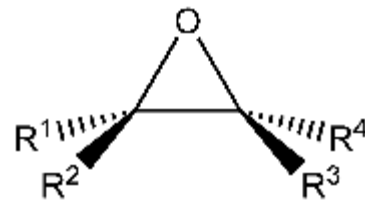
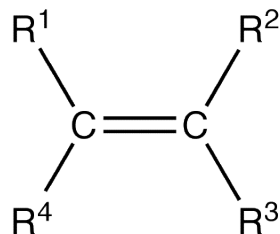
*"Identify a current biological,
environmental, or medical
issue, and discuss **genetically
modified organisms** that might
provide solutions."*

**NEW in
2015**
Team Multimedia
Competition

The graphic includes the iGEM logo (a green gear with a DNA helix) and The University of Sydney crest (a shield with a cross and stars). The background features a detailed black and white illustration of a cityscape where nature and technology are intertwined. A large tree with a DNA helix as its trunk stands in the foreground. In the background, there are skyscrapers, a satellite dish, a wind turbine, and a DNA helix on the ground.

MycoMimic - Our Project

- Develop Genetically Modified host capable of epoxide synthesis

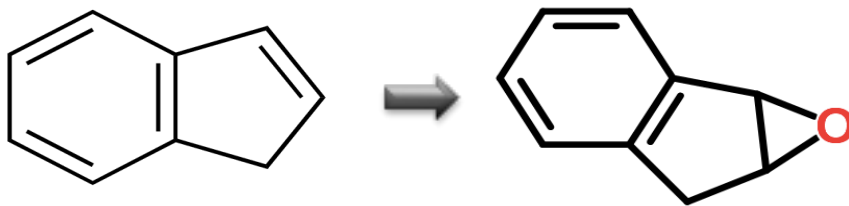


Aims:

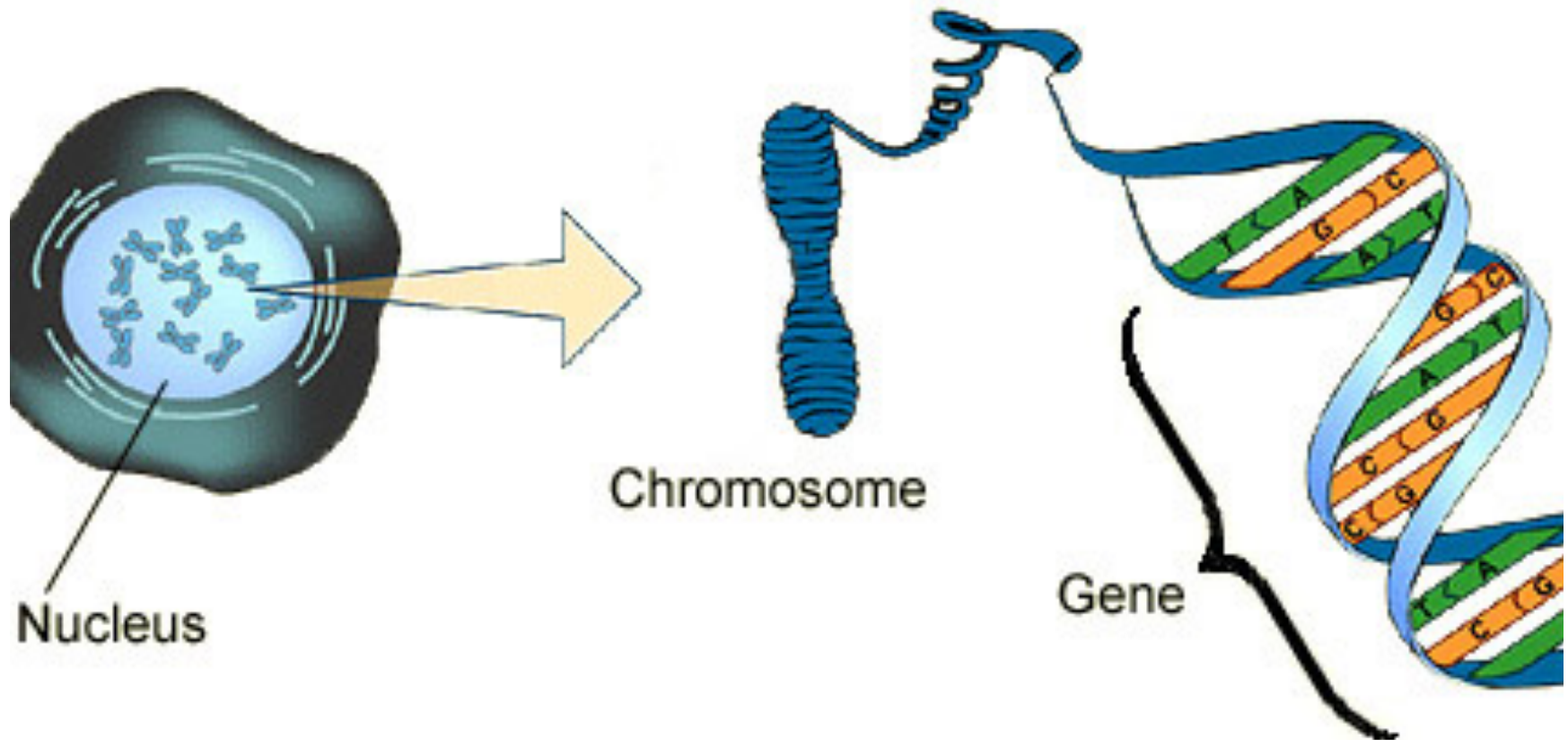
- High enzyme activity
- Fast growing host
- Easily manipulated host

Applications

- Ethane oxide important raw material
e.g. Pharmaceuticals, textile, polymers
- Further optimisation → HIV drug



Lets get into the SCIENCE!



How do genes become functional?

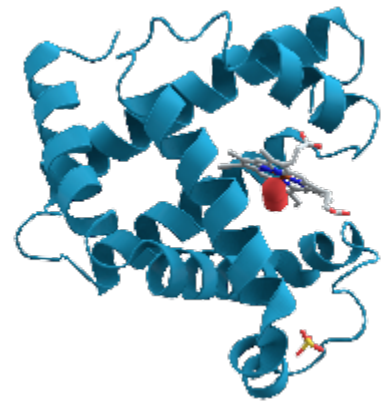
DNA



RNA

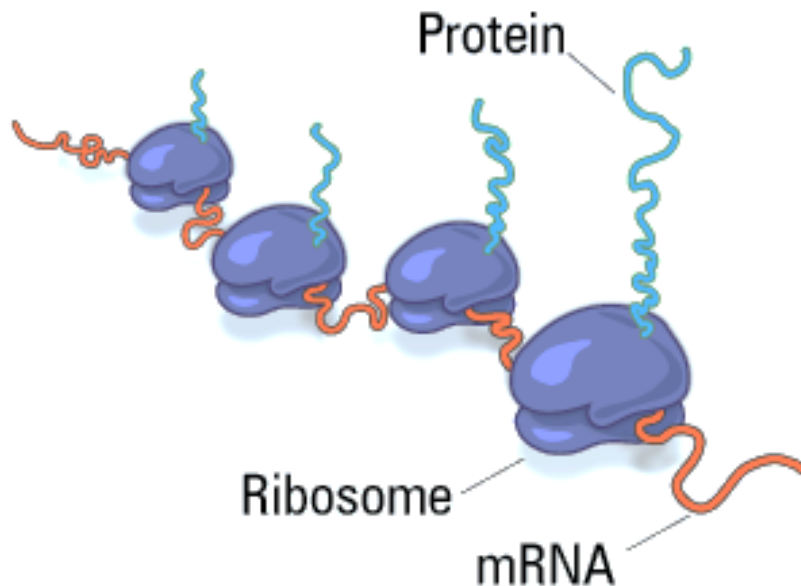


Protein

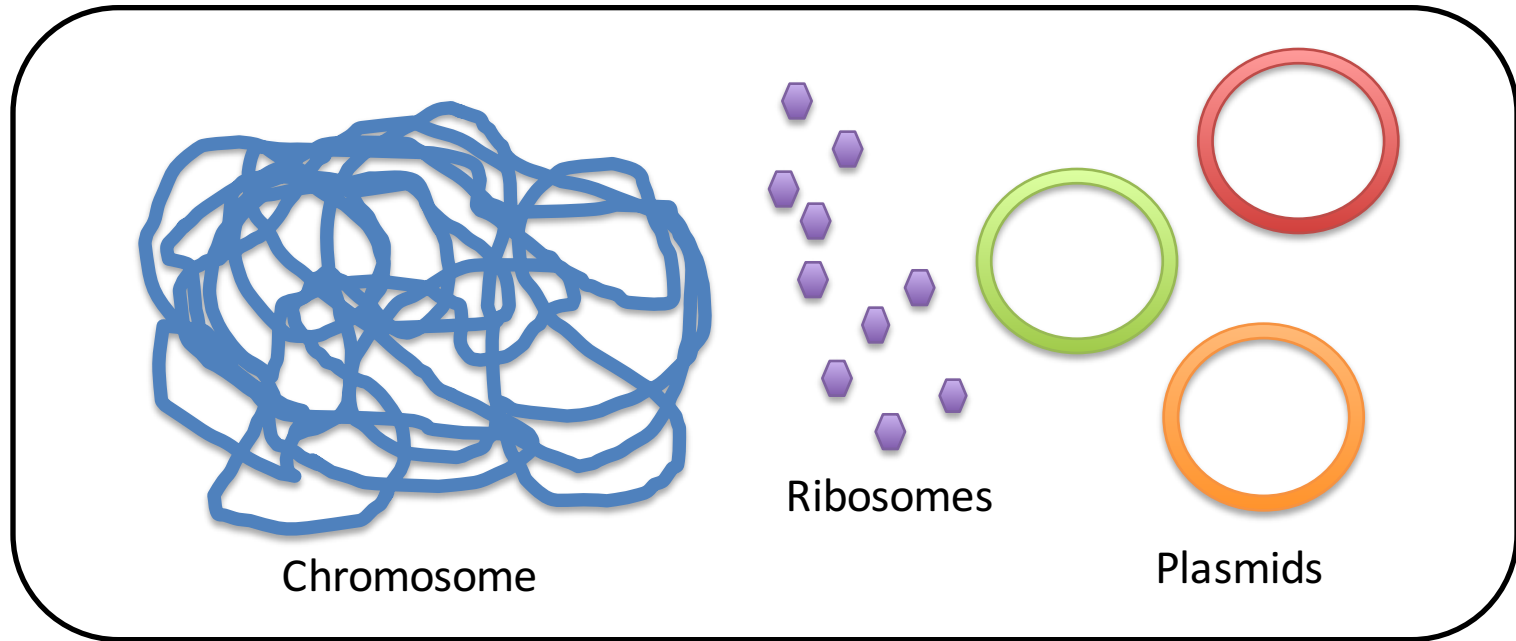


Ribosomes – “Protein Factory”

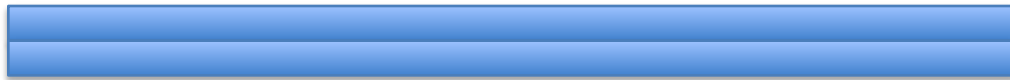
- Scan ‘barcode’ → ‘price’
- Scan RNA → protein



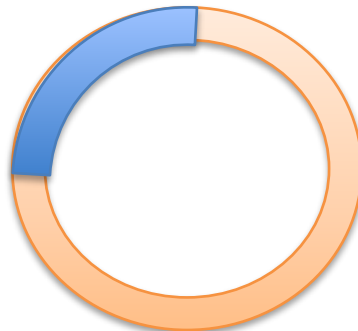
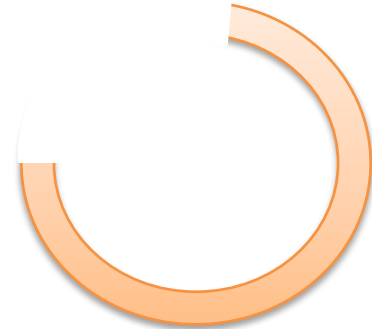
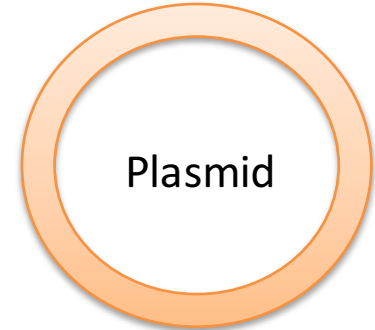
Bacteria - *E.coli*



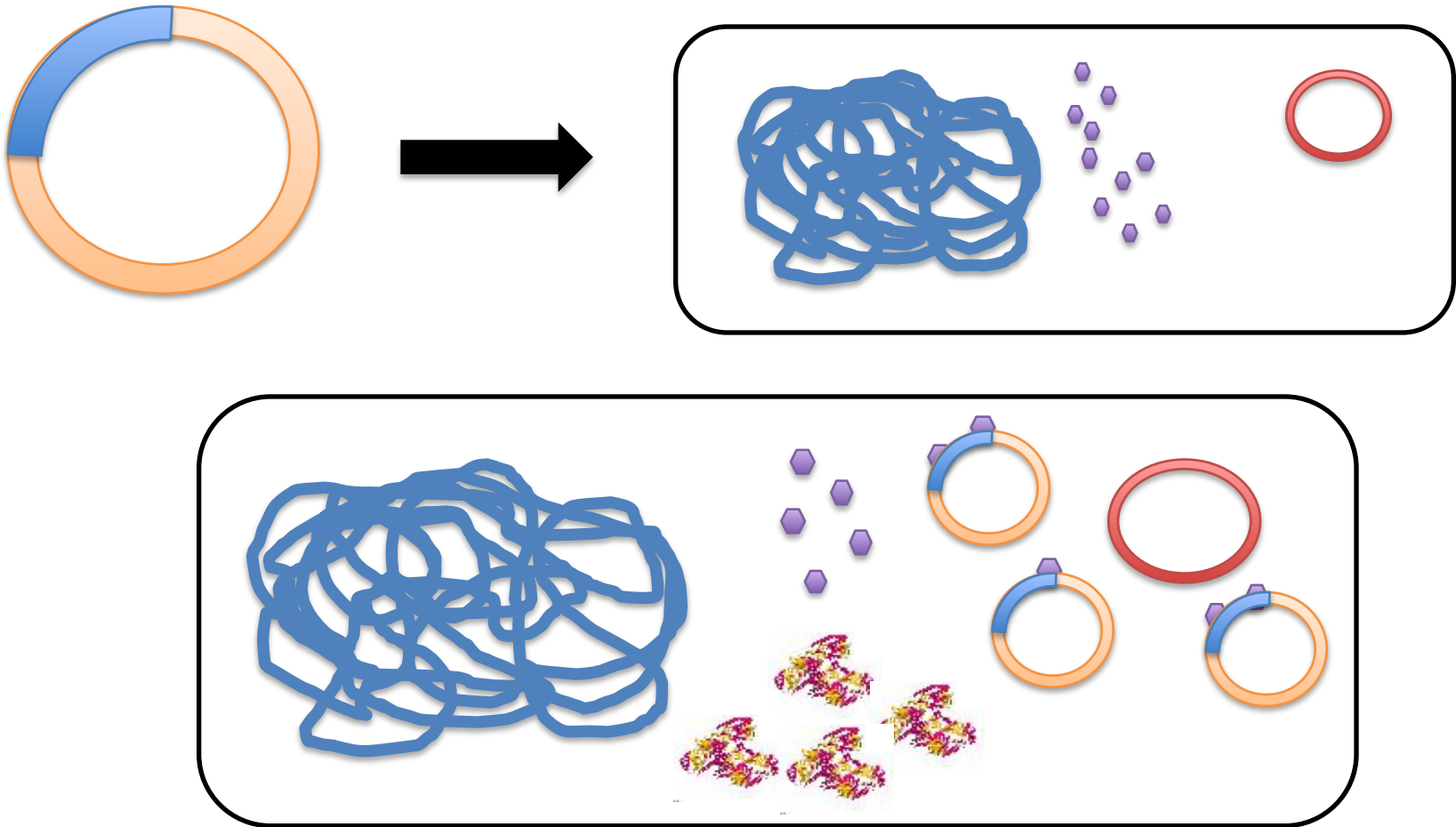
STEP 1: CUT DNA AND PLASMID



DNA (containing gene of interest)

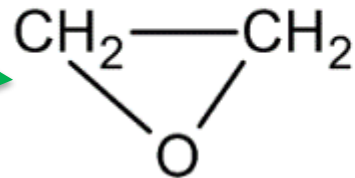
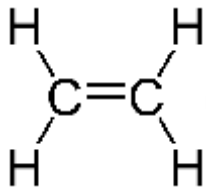
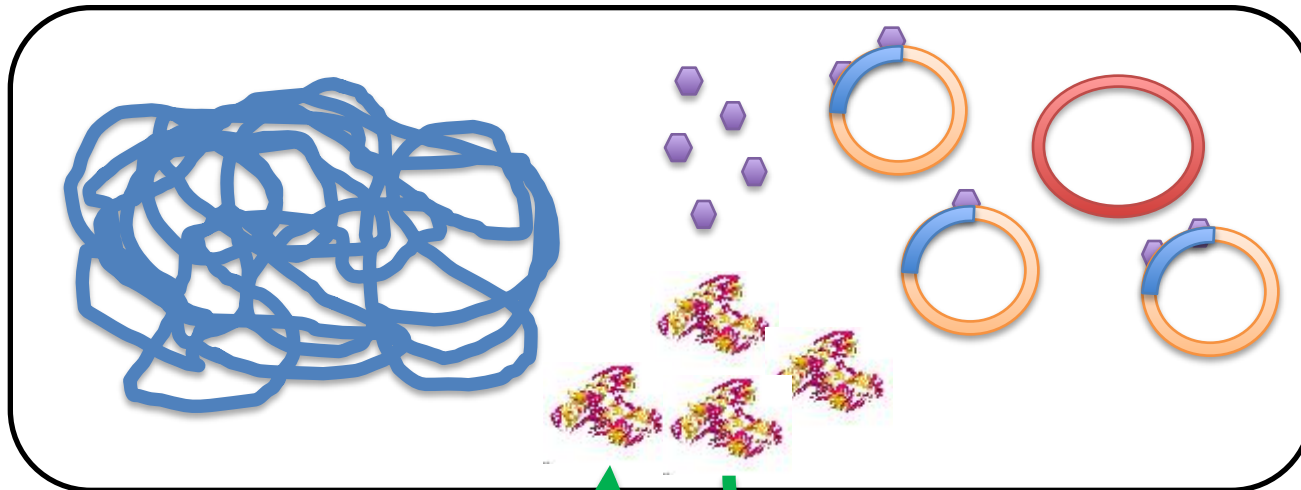


STEP 2: INSERT INTO BACTERIAL CELLS TO GROW



Monooxygenase (MO)

- Inserted gene
- Enzyme



Modelling

Information \Leftrightarrow quality of protein

DNA sequence \Leftrightarrow translation rate

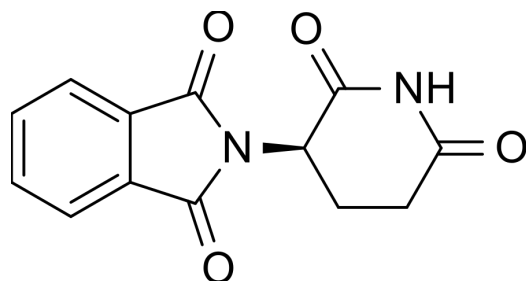
Modelling Example



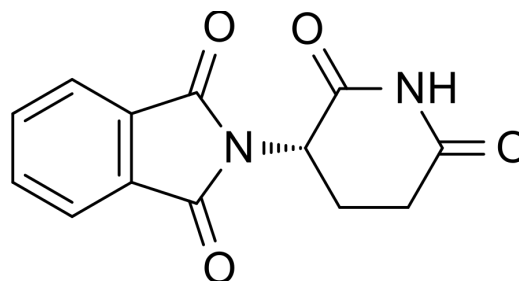
Thalidomide

- So what happened to the story?

Could have been prevented with biocatalysis.



(R)-thalidomide



(S)-thalidomide

Four Way Test

- Is it the truth?
- Is it fair to all concerned?
- Will it build goodwill and better friendships?
- Will it be beneficial to all concerned?

UNIVERSITY OF SYDNEY - iGEM

Sponsorship Opportunities

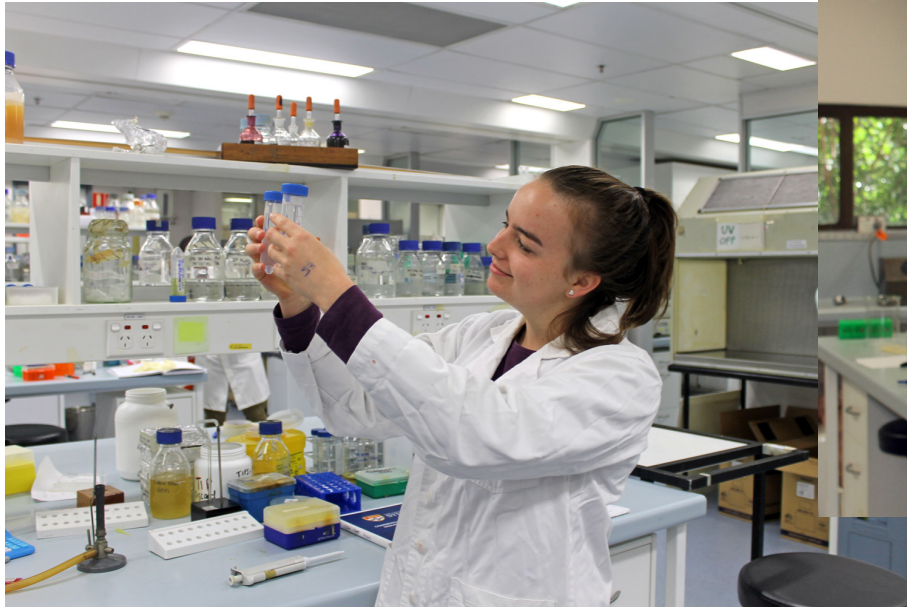


School of Molecular
Biosciences
Building G08, Maze
Crescent

The University of Sydney
Darlington, NSW, 2006,
Australia



iGEM Sydney Team 2015



Elizabeth - Leader
Molecular biology &
genetics
Ancient History
Performance Studies

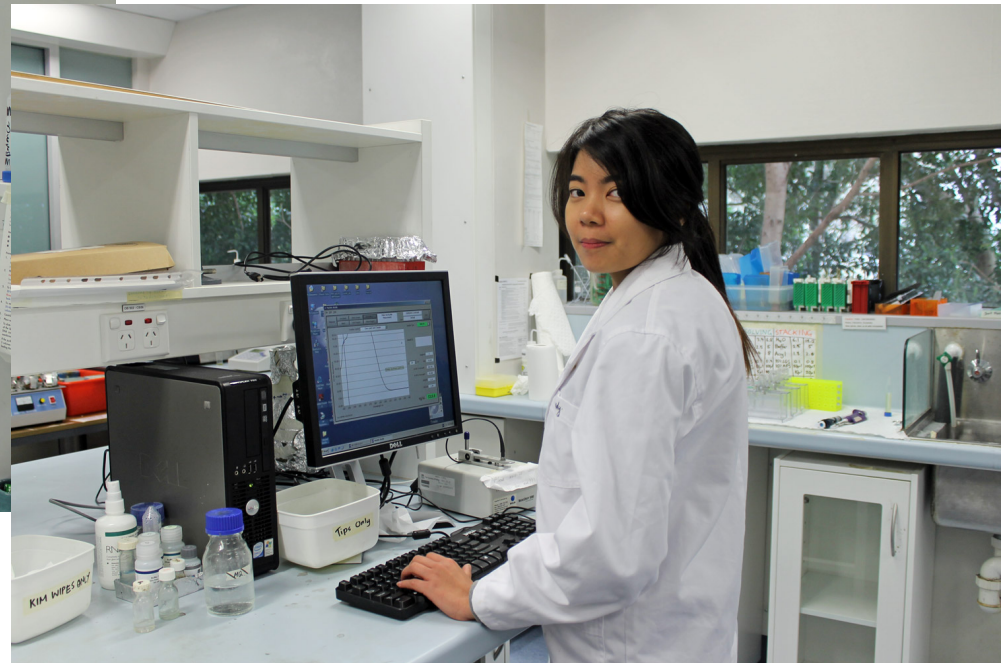


Mark – Lab Leader
Biochemistry
Biology

iGEM Sydney Team 2015



Gaia
Biochemistry
Molecular biology &
genetics



Sandi
Microbiology
Molecular biology &
genetics

iGEM Sydney Team 2015



Mahiar
Biochemistry
Mathematics



Harry
Engineering
Physics
Mathematics

Thank YOU

